CLAIMS

We claim:

1. A method of constructing a cellular structure having nodes therein comprising:

providing at least one truss layer comprised of at least one truss unit, at least one of said truss units being comprised of truss members;

providing at least one panel in mechanical communication with said at least one truss unit of said at least one truss layer, said mechanical communication defines contact regions wherein said at least one truss unit is coupled to said at least one panel;

said nodes being defined as intersections existing among any of said truss members and said nodes also being defined by said contact regions;

providing at least one node pin, said at least one node pin spanning between two desired said nodes; and

diffusion bonding at least one of said truss layer to said at least one panel, said bonding includes:

applying heat, and

applying force that results in said truss layer and said panel that are being bonded to be pressed together, said node pins provide support for the structure so as to concentrate or transmit the applied force onto said contact regions.

2 The method of claim 1, wherein the applied force onto said contact regions provides a node pressure, said node pressure being said applied force or portion of said applied force transmitted or concentrated upon said contact regions divided by the sum of the area of said contact regions.

3. The method of claim 1, further comprising removing at least one of said node pins.

4. The method of claim 1, further comprising providing at least a second panel in mechanical communication with said at least one truss layer distal from said initially provided panel.

5. The method of claim 1, further comprising providing at least a second truss layer in mechanical communication with said at least one truss layer, said mechanical communication defines contact regions wherein said at least one truss unit is coupled to said at least second truss layer.

6. The method of claim 5, further comprising providing at least a second panel in mechanical communication with said second truss layer distal from said initially provided panel.

7. The method of claim 5, further comprising providing at least a second panel in mechanical communication between said first truss layer and said second truss layer.

8. The method of claim 1, wherein said at least one truss layer and said at least one panel comprise at least one select material, wherein said select material comprise:

titanium or titanium alloy or any combination thereof.

9. The method of claim 1, wherein said at least one truss layer and said at least one panel comprise at least one select material , wherein said select material comprise:

at least one of . Ti-6Al-4V, TiAl, TiAlV, Ti, CP (Commercially pure) Ti, Ti-3Al-2.5V, Ti-5Al-2.5 Sn, Ti-6211, Ti-6242, Ti-8Al-1Mo-1V, Ti-11, TIMETAL 1100, IMI 230, IMI 417, IMI 679, IMI 685, IMI 829, IMI 834, Ti-5Al-6 Sn-2 Zr-1Mo-0.1 Si, Ti-17, Ti-6246, Ti-6Al-6V-2 Sn, Ti-7Al-4Mo, TIMETAL 62 S, SP-700, IMI 367, IMI 550, IMI 551, Corona 5, Ti-6-22-22-S, Ti-4Al-3Mo-1V, Ti-5Al-1.5Fe-1.4Cr-1.2Mo, Ti-5Al-2.5Fe,

Ti-5Al-5 Sn-2 Zr-2Mo-0.25 Si, Ti-6.4Al-1.2Fe, Ti-2Fe-2Cr-2Mo, Ti-8Mn, Beta III, Beta C, Ti-10-2-3, Ti-13V-11Cr-3Al, Ti-15-3, TIMETAL 21 S, Beta CEZ, Ti-8Mo-8V-2Fe-3Al, Ti-15Mo-5 Zr, Ti-15Mo-5 Zr-3Al, Transage 129, Transage 134, Transage 175, Ti-8V-5Fe-1Al, Ti-16V-2.5Al, Ti- aluminides, Ti3Al alloys, Gamma TiAl alloys, and/or TiNi smart metal alloys (SMA's).

10. The method of claim 1, wherein said at least one truss layer and said at least one panel comprise at least one select material, wherein said select material comprise:

ceramic, polymer, metal, metal alloy, and/or semiconductor or any combination or composites thereof.

11. The method of claim 1, wherein said heat provides a temperature environment in the range of about 2000 °C to about 3730 °C.

12. The method of claim 1, wherein said heat provides a temperature environment in the range of about 200 °C to about 2000 °C.

13. The method of claim 1, wherein said heat provides a temperature environment in the range of about 400 °C to about 1500 °C.

14. The method of claim 1, wherein said heat provides a temperature environment in the range of about 650 °C to about 950 °C.

15. The method of claim 1, wherein said heat provides a temperature environment in the range of about 100 °C to about 300 °C.

16. The method of claim 1, wherein the applied node pressure is in the range of about 0.01 MPa to about 1000 MPa.

17. The method of claim 1, wherein the applied node pressure is in the range of about 0.01 MPa to about 500 MPa.

18. The method of claim 1, wherein the applied node pressure is in the range of about 1 MPa to about 100 MPa.

19. The method of claim 1, wherein the applied node pressure is in the range of about 0.1 MPa to about 100 MPa.

20. The method of claim 1, wherein at least one of said truss units have units have a geometrical shape of at least one of: tetrahedral, pyramidal, Kagome, cone, frustum, or combinations thereof and other non-limiting arrangements.

21. The method of claim 1, wherein at least one of said truss units have leg members.

22. The method of claim 21, wherein at least one of said leg members is hollow or solid or combination thereof.

23. A method of constructing a cellular structure having nodes therein comprising:

providing at least one intermediate member;

bending at least one of said intermediate member to form a truss layer comprised of at least one truss unit, at least one of said truss units being comprised of truss members;

providing at least one panel in mechanical communication with said at least one truss unit of said at least one truss layer, said mechanical communication defines contact regions wherein said at least one truss unit is coupled to said at least one panel;

said nodes being defined as intersections existing among any of said truss members and said nodes also being defined by said contact regions;

providing at least one node pin, said at least one node pin spanning between two desired said nodes; and

diffusion bonding at least one of said truss layer to said at least one panel, said bonding includes:

applying heat, and

applying force that results in said truss layer and said panel that are being bonded to be pressed together, said node pins provide support for the structure so as to concentrate or transmit the applied force onto said contact regions.

24. The method of claim 23, wherein the applied force onto said contact regions provides a node pressure, said node pressure being said applied force or portion of said applied force transmitted or concentrated upon said contact regions divided by the sum of the area of said contact regions.

25. The method of claim 23, wherein at least one of said intermediate member comprises a porous, mesh, or aperture sheet.

26. The method of claim 25, wherein said pores or apertures of said intermediate member including a circular, square, rectangular, hexagonal, triangular, ellipsoidal, pentagonal, octagonal, or combinations thereof or other desired shape.

27. The method of claim 25, wherein

said pores or apertures are square, rectangular, parallelogram, or four sided shape whereby said bent intermediate member provides said array of said truss units whereby said truss units have a pyramidal shape.

28. The method of claim 25, wherein

said pores or apertures are hexagonal whereby said bent prefabricated layer provides said array of said truss units whereby said truss units have a tetrahedral shape.

29. The method of claim 23, wherein at least one of said intermediate member comprises an array of intersecting structural elements..

30. The method of claim 23, wherein said intermediate member further comprises a second array of intersecting structural elements stacked on top of said first array of intersecting structural elements.

31. The method of claim 23, wherein said intermediate member further comprises a second array of intersecting structural elements coupled to said first array of intersecting structural elements.

32. The method of claim 23, wherein at least one of said structure member comprises an array of braided textile structural elements.

33. The method of claim 23, wherein at least one of said structure member comprises an array of intersecting textile structural elements.

34. A method of constructing a cellular structure having nodes therein comprising:

providing at least one intermediate member;

providing at least one panel;

providing at least two node pins, said at least two node pins located between said intermediate member and said panel;

applying at least one level of force that results in:

said intermediate layer to be at least one of bent, stretched, and/or otherwise deformed or combination thereof into a desired geometry in response to at least in part to said node pins to form at least one truss layer, said at least one truss layer being in mechanical communication with said panel, said mechanical communication defines contact regions wherein said at least one truss unit is coupled to said at least one panel; and

diffusion bonding at least one of said truss layer to said at least one panel, said bonding includes:

applying said at least one level of force that results in said truss layer and said panel that are being bonded to be pressed together, said node pins provide support for the structure so as to concentrate or transmit the applied force onto said contact regions.

35. The method of claim 34, wherein said at least one level of applied force onto said contact regions provides a node pressure, said node pressure being said applied force or portion of said applied force transmitted or concentrated upon said contact regions divided by the sum of the area of said contact regions.

36. The method of claim34, wherein said force for bending, stretching, or otherwise deforming is applied at least partially simultaneously during said force for bonding.

37. The method of claim34, wherein said force for bending, stretching, or otherwise deforming is applied prior to said force for bonding.

38. The method of claim34, wherein said force for bending, stretching, or otherwise deforming is applied partially after said force for bonding.

39. A cellular structure having nodes therein comprising:

at least one truss layer comprised of at least one truss unit, at least one of said truss units being comprised of truss members; and

at least one panel in mechanical communication with said at least one truss unit of said at least one truss layer, said mechanical communication defines contact regions wherein said at least one truss unit is coupled to said at least one panel; and

said nodes being defined as intersections existing among any of said truss members and said nodes also being defined by said contact regions,

said at least one of said truss layer is diffusion bonded to said at least one panel, whereby said diffusion bonding comprises:

providing at least one node pin, said at least one node pin spanning between desired said nodes,

applying heat, and

applying force that results in said truss layer and said panel that are being bonded to be pressed together, said node pins provide support for the structure so as to concentrate or transmit the applied force onto said contact regions.

40. The structure of claim 39, wherein the applied force onto said contact regions provides a node pressure, said node pressure being said applied force or portion of said applied force transmitted or concentrated upon said contact regions divided by the sum of the area of said contact regions.

41. The structure as produced according to the method recited in any one of claims 1, 23, or 34.